Space Weather Technical Forecast

Issued on Sunday, 28 January 2024 at 13:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 Minor Storms either late on 29 or 30 January due to the onset of a high speed stream. Chance of isolated M-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with only low-level C-class flares observed. There are five sunspot regions on the visible disc, of which AR3559 is the largest. This appears to have weakened slightly, although it is becoming more difficult to assess as it approaches the western limb. AR3560 has grown over the last few days, but appears to be stable or decreasing now as it also approaches the limb. The three unnumbered regions are small and relatively simple. No Earth-directed CMEs were observed, but multiple CMEs were seen emanating from the far side of the Sun.

Solar Wind / Geomagnetic Activity: Solar winds have been at ambient speeds, with density mainly average or below average. Total magnetic field strength, Bt was weak initially, with the north-south component, Bz also oscillating weakly. Bt has increased gradually over the last 24 hours and has been largely moderate since around 28/0300UTC, with Bz ranging between +10 and -5nT. Phi angle was mainly positive (away from the Sun) with some variation into the negative sector between 27/1200UTC and 27/1800UTC, then again from 28/1000UTC. Geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background. GOES16 high energy (greater than 2MeV) electron flux was at background. The associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold on a steady trend. At 28/0000UTC the 24-hour integrated fluence observation was 1.18e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Mainly Low activity forecast, with isolated M-class flares possible.

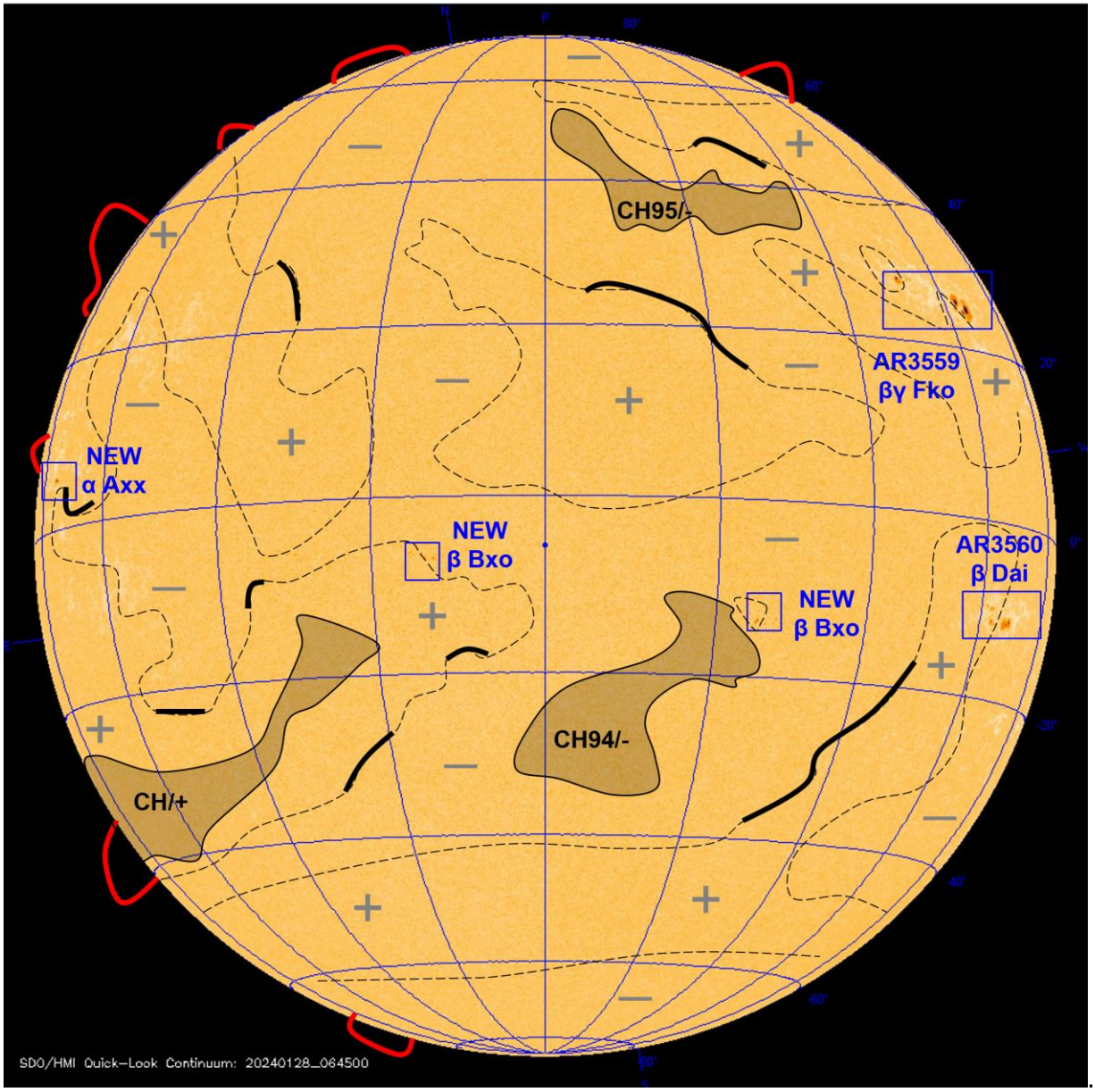
Solar Wind / Geomagnetic Activity: No CMEs are currently forecast to affect Earth. Solar wind speeds are forecast to increase from background values to reach 450-500km/s either late on 29 or into 30 January due to a connection to coronal hole 94. Geomagnetic activity is forecast to be mainly Quiet, but may reach Active or G1/Minor Storm levels due to the onset of the coronal hole high speed stream.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background with only a slight chance of rising to in response to any notable flares from the sunspots near or just over the west limb. High energy electron flux (greater than 2MeV) is expected to persist at mainly background until at least 30 January, when an increase is then possible following the onset of any fast winds. The associated electron fluence is forecast to remain well below the Active threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1. Solar Analysis Valid 28/0645UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

No CMEs are currently expected to arrive at Earth during the forecast period.

Solar winds are at background, with the next enhancement expected from coronal hole 94 either late on 29 or during 30 January. Solar wind speeds from this feature caused little increase on the last rotation, but higher speeds of 450-500km/s are forecast on this rotation due to the slightly stronger appearance of the coronal hole and its position relative to Earth. As this is a negative coronal hole, a stronger response is increasingly favoured approaching the March equinox, but this effect is still likely to limited at this time of year. The coronal hole is a recurrent feature, with a risk of a CIR (co-rotating interaction region) ahead of the coronal hole high speed stream connection which could enhance any response during the onset of the high speed stream. Coronal hole 95 is expected to be too far north to affect the Earth.

Mainly Quiet geomagnetic activity is expected in the absence of any CME arrivals. The high speed stream connection either late on 29 or during 30 January may result in Unsettled to Active intervals, with a chance of G1/Minor storms during the initial connection of the high speed stream, decreasing on 31 January.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	20	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares:

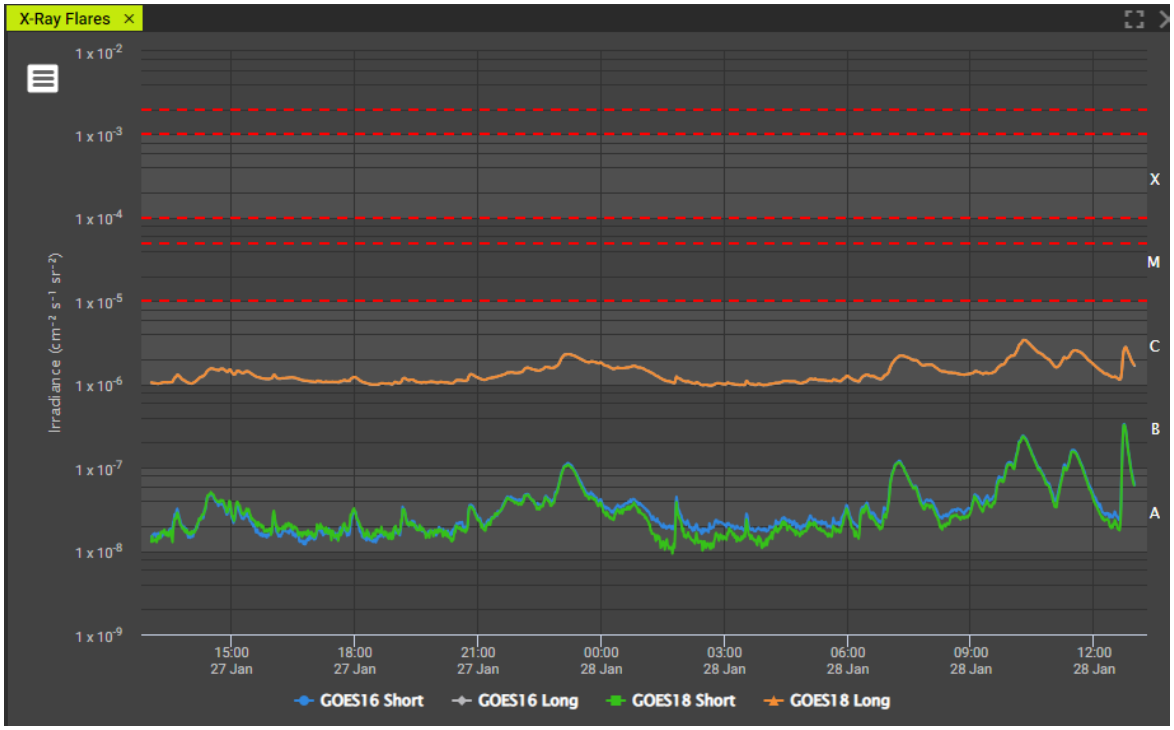
Low activity is forecast with a chance of isolated M-class flares, mainly from AR3559 and AR3560, which are approaching the western limb.

Ex-AR3561 which is now beyond the western limb, was responsible for much of the recent activity, and still presents a limited risk due to any flares which are elevated above the limb. The risk of M-class flares is then expected to decline as this region continues to rotate onto the far side. AR3559, which has simplified through the last few days, continues to present an elevated flare risk. There is also a risk of significant active regions rotating across the eastern limb through the forecast period, evidenced by two large far-sided CME during 27 January.

The balance of departing regions and potential emergence, leads to a steady forecast of a chance of further M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	2	1	1	1

Figure 2: GOES16/18 X-Ray Flares



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

GOES18 high energy (greater than 10MeV) proton flux is at background. Despite AR3559 showing signs of weakening, there remains a slight chance of any notable flares from this region, AR3560 or ex-AR3561 increasing the observed flux at Earth, with a very slight and reducing chance of reaching the S1/Minor Radiation storm level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	5	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is expected to remain at background levels during much of the forecast period, with no CME enhancements expected. A high speed stream connection, forecast for either late on 29 January or during 30 January may contribute to the radiation belts and lead to an upward trend in electron flux values. Values may then reach high levels on diurnal highs by the end of the period.

Electron fluence values may begin to also trend upwards towards the end of the forecast period due to the anticipated increase in electron flux values. However these are unlikely to exceed the Active (1e8 integrated pfu) threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.